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SUBJECT: Trip Report: Symposium on "Operations Research in Space," Santa Barbara, California, December 18-19, 1968 - Case 610

DATE: January 16, 1969

FROM: A. B. Baker

MEMORANDUM FOR FILE

On December 18-19, 1968 the writer attended a symposium on "Operations Research in Space" sponsored jointly by the Space Sciences Section of the Operations Research Society of America and the Science and Engineering Extension of the University of California at Santa Barbara. A list of the papers presented at the symposium is given in Appendix A. An asterisk indicates the papers for which preprints were obtained.

Almost half of the papers presented dealt with the problems of space logistics, maintenance, and resupply. The remaining papers covered a wide range of material in the area of computer applications and included discussions of computerized aids to systems design, mission planning, and activity scheduling.

A paper of particular interest (Paper #11) was presented by D. Turner, NASA/OMSF. It reviewed the activity scheduling computer programs currently being used in the aerospace industry. The paper discussed the need for such programs, defined some of the program capabilities which would be most desirable, and discussed the relative merits of several activity scheduling programs already available. The need for these programs arises because the ever-increasing duration and complexity of manned space flight coupled with the reduction in the amount of time required for non-scientific activities has so broadened the scheduling alternatives that they cannot adequately be evaluated by hand. The next generation of space missions, beginning with the AAP earth orbital flights, will almost certainly require some form of automated scheduling.

One of the most desirable capabilities would be the flexibility to contribute to all phases of program planning from preliminary studies to real-time updating of activity schedules during operational missions. The latter capability would be particularly useful to personnel in the Mission Control Center when off-nominal situations require revisions to the nominal schedule. Other desirable features for an activity scheduling program would be the capability to generate an activity timeline, the ability to consider the effects of scheduling on subsequent activities, and facility of operation.

Mr. Turner presented a list of fifteen activity scheduling models which are in various stages of development. This list is reproduced in Table 1. It was concluded that none of the programs currently available would fulfill NASA's requirements but that at least two showed some promise: Lockheed's SAMSON program and TRW's Experiments Scheduling Program. Though the latter is the most promising of all, it is not yet an operational program.

A. B. Baker

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Attachments

TABLE 1

ACTIVITY SCHEDULING MODELS

1. SAM (SCHEDULING ANALYSIS MODEL); MARTIN-MARIETTA
2. SAMMIE (SCHEDULING ANALYSIS MODEL FOR MISSION INTEGRATED EXPERIMENTS); MARTIN
3. CASP (CREW ACTIVITIES SCHEDULING PROGRAM); GENERAL ELECTRIC
4. FORRCAST (FORMULATION OF RESOURCE REQUIREMENTS BY COMPUTER ASSISTED SCHEDULING TECHNIQUES); LOCKHEED
5. SAMSON (SYSTEM ANALYSIS OF MANNED SPACE OPERATIONS); LOCKHEED
6. GSS (GENERAL SCHEDULING SUBROUTINE); GENERAL DYNAMICS
7. MATE (MISSION ANALYSIS TECHNIQUE FOR EXPERIMENTS); BOEING
8. SPEED; DOUGLAS
9. ACTNET (ACTIVITY NETWORK); DOUGLAS
10. P/S/A (PLANNING, SCHEDULING, AND RESOURCE ALLOCATION); MITRE
11. TOPSIE; IBM
12. MASCOT; NORTH AMERICAN ROCKWELL
13. SAMPL; BELLCOMM
14. SDOA (SYSTEMS DESIGN AND OPERATIONS ANALYSIS); LOCKHEED
15. EXPERIMENTS SCHEDULING PROGRAM; TRW

APPENDIX A

Papers Presented at the Symposium on "Operations Research in Space"

*1. "Space Based Supply and Lunar Astronomy,"
R. J. Freeman, General Electric, Santa Barbara, California;
R. Moore and G. Schilling, RAND Corporation, Santa Monica, California.

2. "Space Station Logistics, Supply, Maintenance,"
C. B. Moore and T. E. Peace, General Dynamics, Fort Worth, Texas.

*3. "A Technique for Evaluation of Space Logistics System Effectiveness,"
P. B. McKowen and D. F. Steward, Martin-Marietta Corporation, Denver, Colorado.

*4. "Predicting Maintenance Time Distribution of a Complex System - A Monte Carlo Solution,"
W. R. Downs, McDonnell-Douglas, Huntington Beach, California.

5. "Optimization of System Design Through Dynamic Programming,"
J. B. Todaro, Frankfort Arsenal, Department of Army, Philadelphia, Pennsylvania.

*6. "Logistics and Operations Design Using Activity Networks,"
J. R. Brinsley and J. B. Newton, McDonnell-Douglas, Huntington Beach, California.

*7. "Current State-of-the-Art in NASA's Computerized Costing Programs,"
H. C. Mandell, Jr., NASA Manned Spacecraft Center, Houston, Texas.

8. "Software Simulation of Space Missions,"
L. Gainen and M. Lodato, McDonnell-Douglas, Huntington Beach, California.

*9. "Mission Analysis Production Line,"
D. Sonnabend, Ball Brothers Research Corporation, Boulder, Colorado.

10. "Present and Future Possibilities for Conversational Computing,"
R. N. Seitz, NASA Marshall Space Flight Center, Huntsville, Alabama.

11. "A survey of Activity Scheduling Programs for Space Mission Planning,"
D. N. Turner, NASA Headquarters, Office of Manned Spaceflight, Washington, D. C.

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*Preprint Obtained

*12. "Scientific Effectiveness of Space Experiment Payloads," J. B. Weddell, North American Rockwell Corporation, Downey, California.

13. "A Computer Oriented Approach to System Synthesis and Analysis for Aircraft," V. A. Lee, W. J. Moran, J. D. McLeod, H. R. Anderson, and R. H. Wenham, General Dynamics, Fort Worth, Texas.

14. "Program String Structure: A Building Block Approach for Implementing Computer Programs," E. Morenoff and J. McLean, Rome Air Development Center, Griffiss AFB, N. Y.

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*Preprint Obtained